A Virtual Tape Library Architecture & Its Benefits

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A Decade of Enhancing Removable Storage

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AGENDA

- **Changing Trends in Backup**
- **Backup to Disk Momentum**
- **Backup Technologies**
- **Backup Technology Differences**
- **Importance of Tape**
- **VTL Solutions**
- **Summary & Conclusion**

Changing Trends in Backup

Backup to Disks was always available

- *IBM VTS*

- *Too Expensive*

- *Platform Centric*

Recent Trends in Disk Drive Technology

- *Huge price drops in ATA disk drives*

- *ATA performance is good enough*

- *RAID provides availability & reliability*

Many "Backup Using Disk" Solutions are publicized in the marketplace
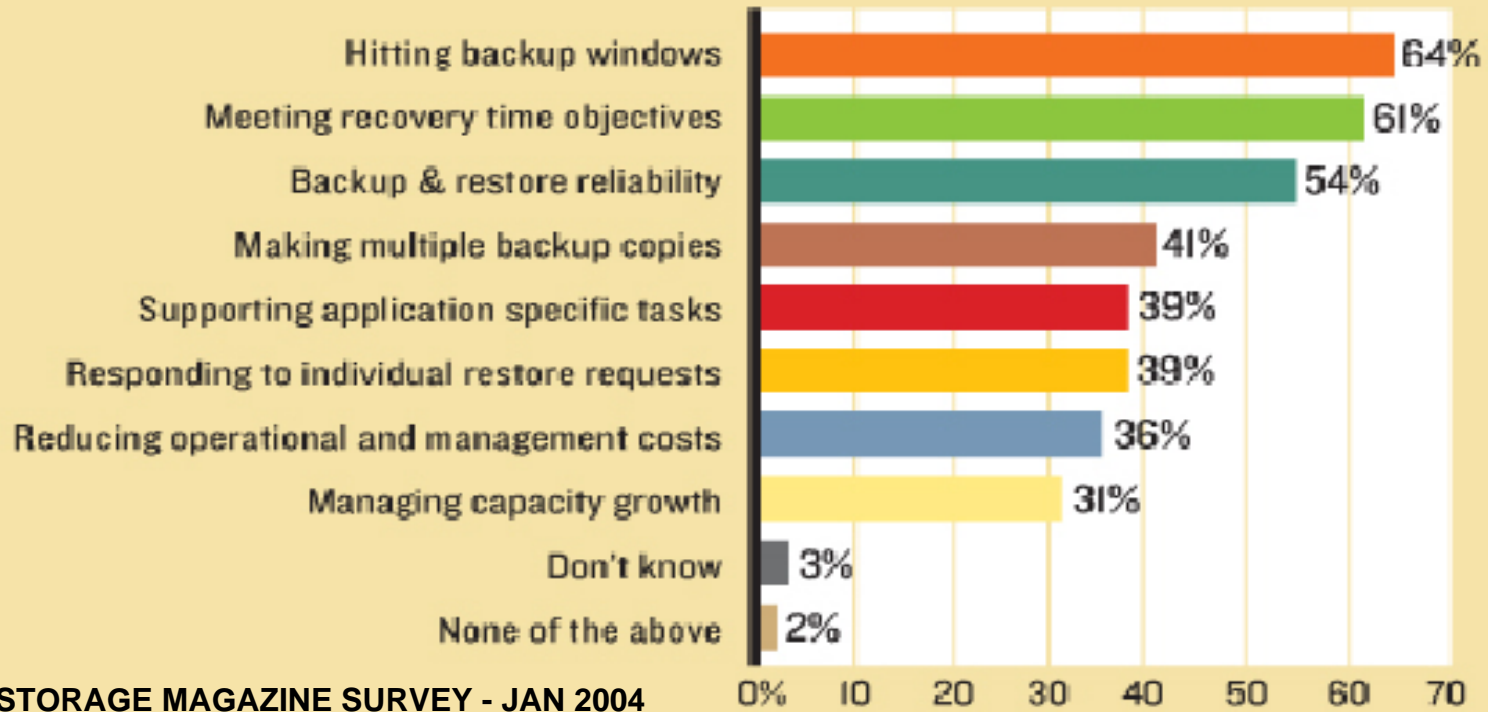
Backup to Disk Momentum

Search for an Ideal Backup Configuration with Policies and Procedures is Never Ending.

- *Company changes forces IT changes*

- *Not enough money*

- *Not enough of the right personnel*

- *Can assets be re-purposed?*

- *Technology exist to solve problems?*

Here is what some IT people said…

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Backup to Disk Momentum

4. Which of the following challenges would disk-based backup help solve?

Challenge	Percentage
Hitting backup windows	64%
Meeting recovery time objectives	61%
Backup & restore reliability	54%
Making multiple backup copies	41%
Supporting application specific tasks	39%
Responding to individual restore requests	39%
Reducing operational and management costs	36%
Managing capacity growth	31%
Don't know	3%
None of the above	2%

STORAGE MAGAZINE SURVEY - JAN 2004
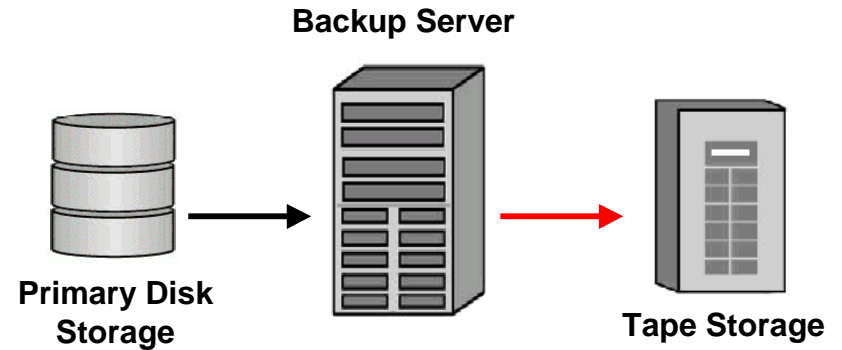
Backup Technologies

Conventional

Disk to Disk (D2D or D2D2T)

Virtual Tape Library (VTL)

- *Software Based Virtual Tape*

- *Appliance Based Virtual Tape*

- *Hardware Based Virtual Tape*

- *Hardware Based with Archive*

Conventional Backup

- Data is backed up from primary disk storage through server to tape

Backup Server

Primary Disk Storage

Tape Storage

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Disk to Disk Based Backup

- Data is backed up from primary disk storage through server to "Backup Disks"

- Data from "Backup Disk" storage is archived through server to tape

- Backup and archive is managed by 3rd party software or proprietary Disk-to-Disk backup software

Backup Server

Primary Disk Storage
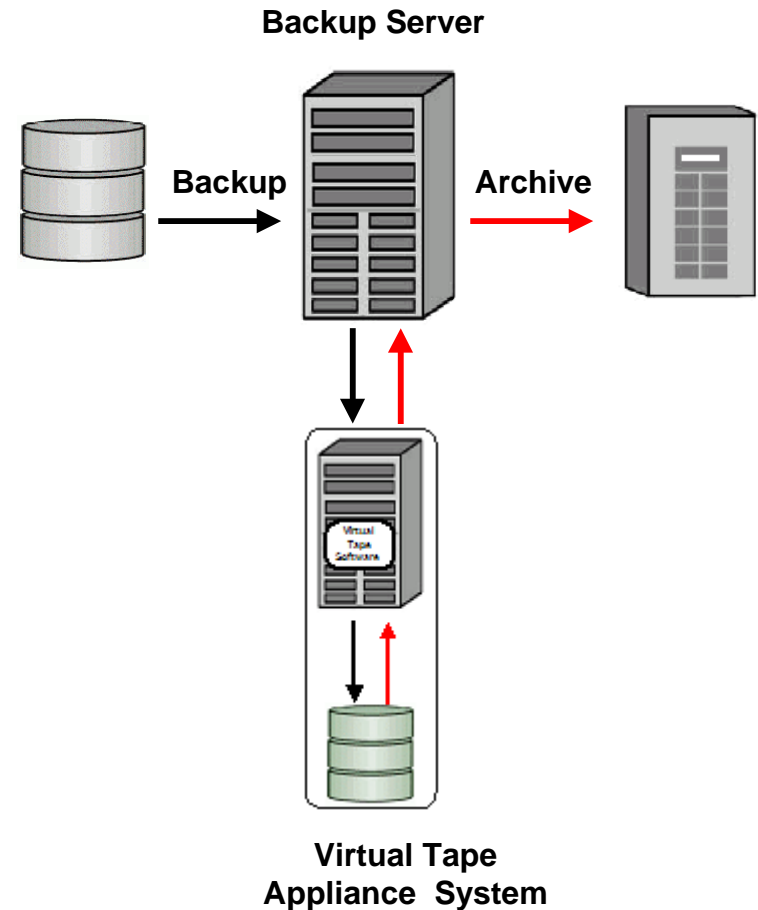
Tape Storage
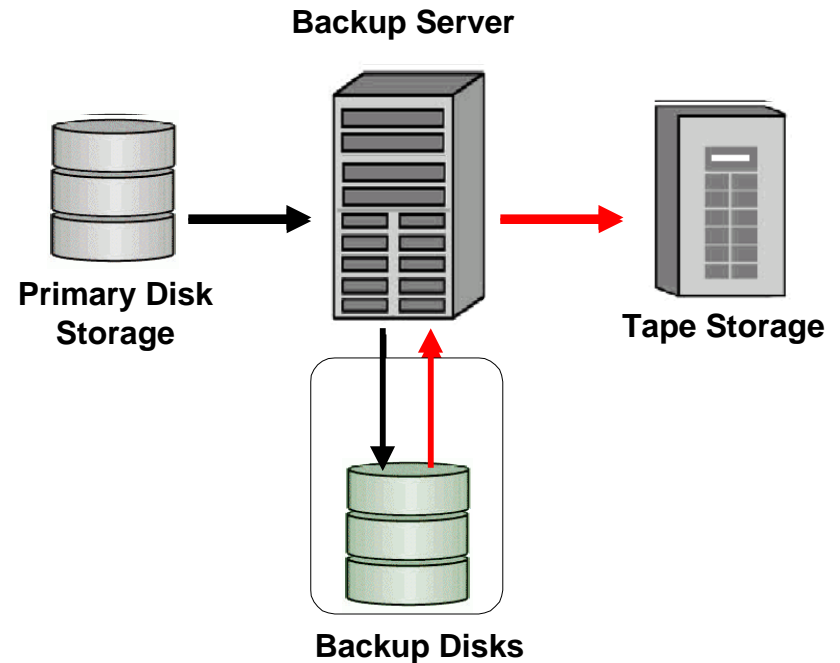
Backup Disks

Software Based Virtual Tape Backup

- An server / disk storage system emulates conventional tape storage

- Virtual tape system software resides on host system

- Backup and archive is managed by backup software on server

Backup Server

Primary Disk Storage

Tape Storage

Virtual Tape Controller

Virtual Tape System

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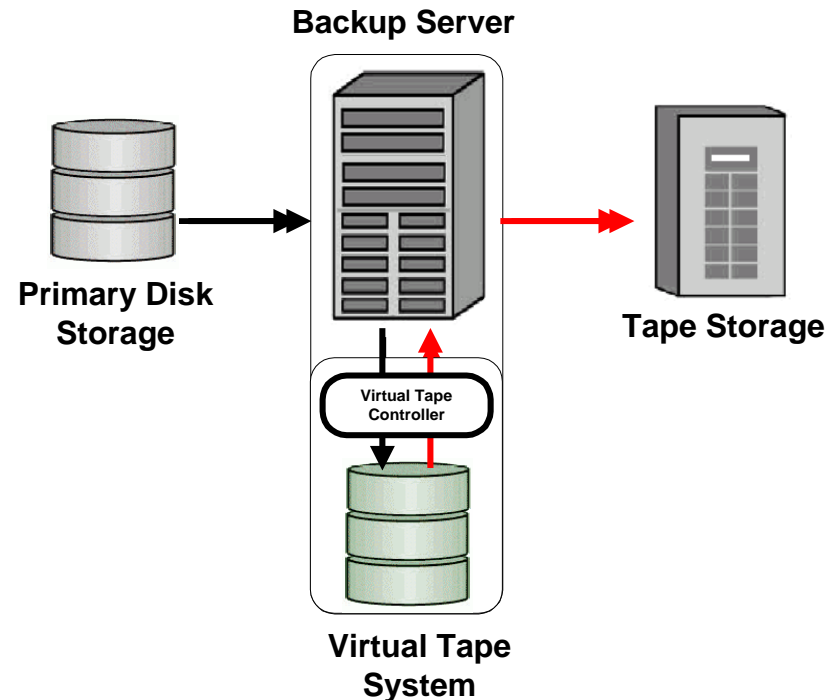
Appliance Based Virtual Tape Backup
## (Using Third Party Archive)

- A server / disk "appliance" with disk storage emulates conventional tape

- Virtual tape system software resides on appliance system

- Backup and archive is managed using traditional backup software running on the backup server

Backup Server

Backup → Archive →

Virtual Tape Software

Virtual Tape Appliance System

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Hardware Based Virtual Tape Backup
## (Using Third Party Archive)

- An independent disk storage system emulates conventional tape storage

- Virtual tape system uses an independent hardware controller

- Data is managed using traditional backup management software

- Archive using 3rd party software

Backup Server

Primary Disk Storage

Tape Storage

Virtual Tape Controller

Virtual Tape System

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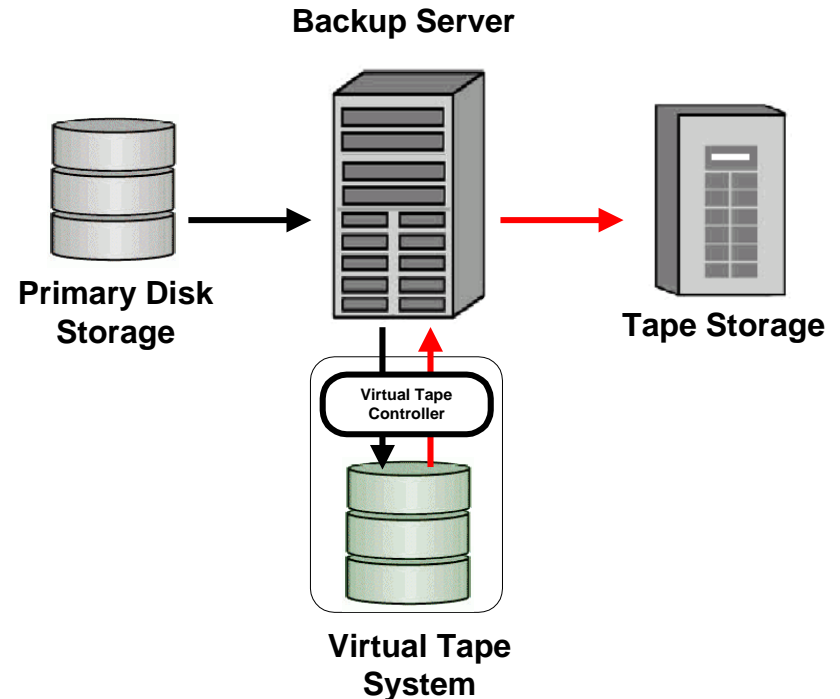
Hardware Based Virtual Tape Backup

(Using Embedded Archive)

- An independent disk storage system emulates conventional tape storage

- Virtual tape system uses an independent hardware controller with archive to attached tape

- Data is managed using traditional backup management software

- Controller manages the archive from VTL disks to conventional tape storage

Backup Server

Primary Disk Storage

Virtual Tape Controller

Disks   **Tape Storage**

Virtual Tape Library

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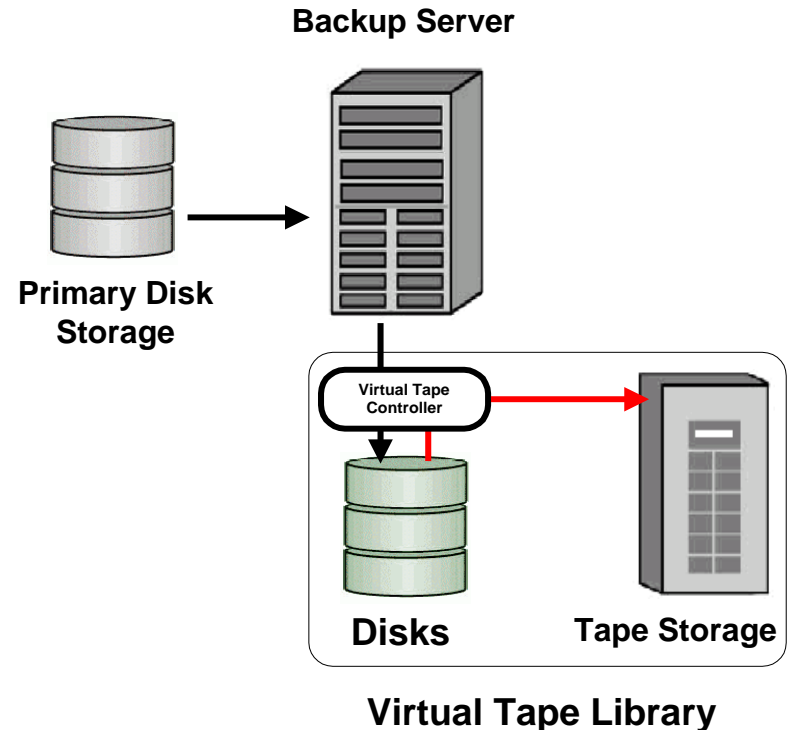
Backup Technology Differences

Disk to Disk Solutions Provide:
- Faster Backup Speeds
- Faster and Near Instant Restores
- Higher Reliability & Availability
- Lower Maintenance Costs

Software / Appliance Based Virtual Tape Solutions Provide:
- Compatible with Traditional Backup Management Software
- Server CPU Bandwidth affects Performance
- Less Vulnerable to Data Corruption or Disk Failure

Hardware Based VTL Solutions with Embedded Archive Provide All Above Plus:
- Controller manages Server free Archive.
- Seamless integration; OS/Platform/Backup Software Independent
- Fast Hardware level Volume Writes; No File System Overhead
- Eliminates Disk Fragmentation
- Least vulnerable to Data Corruption, Accidental Deletion, Virus

Importance of Tape

1. RAID systems are fault tolerant to any single spindle failure, but not disasters, e.g., fire.

2. RAID systems can be replicated at an off-site location, but this is a very expensive alternative.

3. Multiple copies of tape is still the best insurance policy against data loss.

VTLs must archive to tape for Disaster Recovery

Importance of Tape

Even Tape is Not an End All

1. Tape or tape media fails during a write

2. Previously written tape media cannot be read

3. Over 41% of those in the Jan 2004 survey were making multiple backup copies as insurance against data loss

Tape is the most economical and key component of an Overall Data Protection and Recovery System

# Utilizing RAIT Technology to Improve Reliability & Performance

Tape RAID Controllers - RAIT

- 4 independent parallel drives provide up to 4X speed of a single tape drive

- Parity tape drive provides high reliability

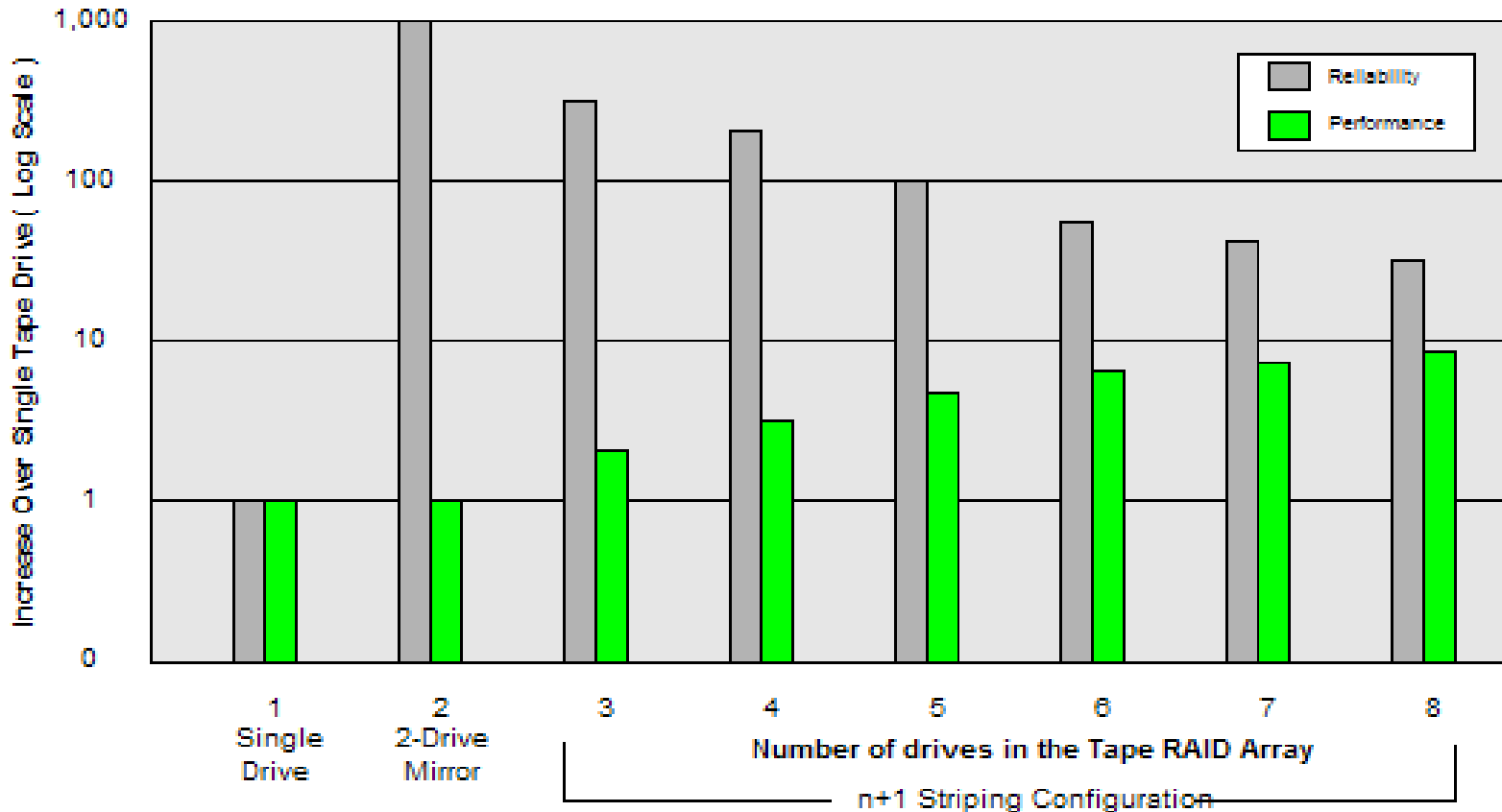- RAIT mirroring creates multiple copies for offsite archival storage

Host

RAIT Controller
(4 Independent Parallel SCSI Channels)

Tape Drive 1   Tape Drive 2   Tape Drive 3   Tape Drive 4

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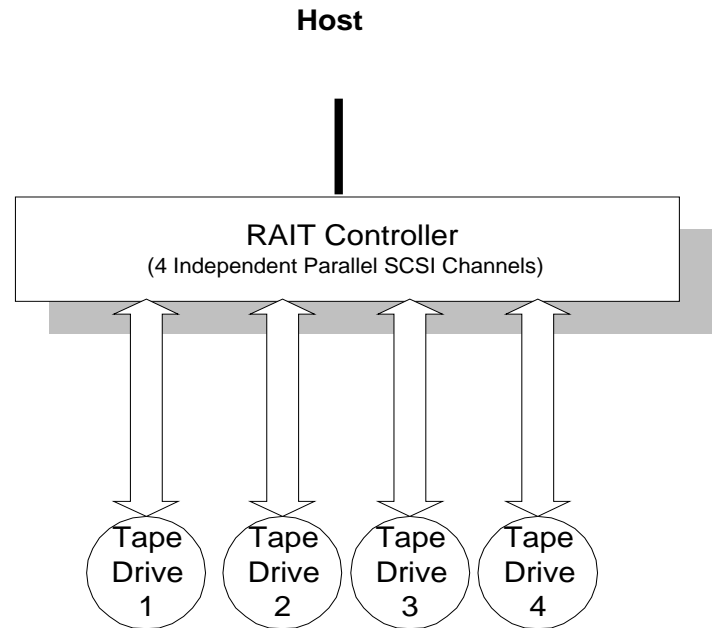
RAIT Solutions

Typical backup rate of a hardware RAIT solution over software RAIT or 4 independent tapes is like getting one drive free

Backup to

percent values: 1 drive ≈ 100, 4 drives ≈ 210, SW RAIT ≈ 225, Ultera ≈ 325

1 drive = 100%

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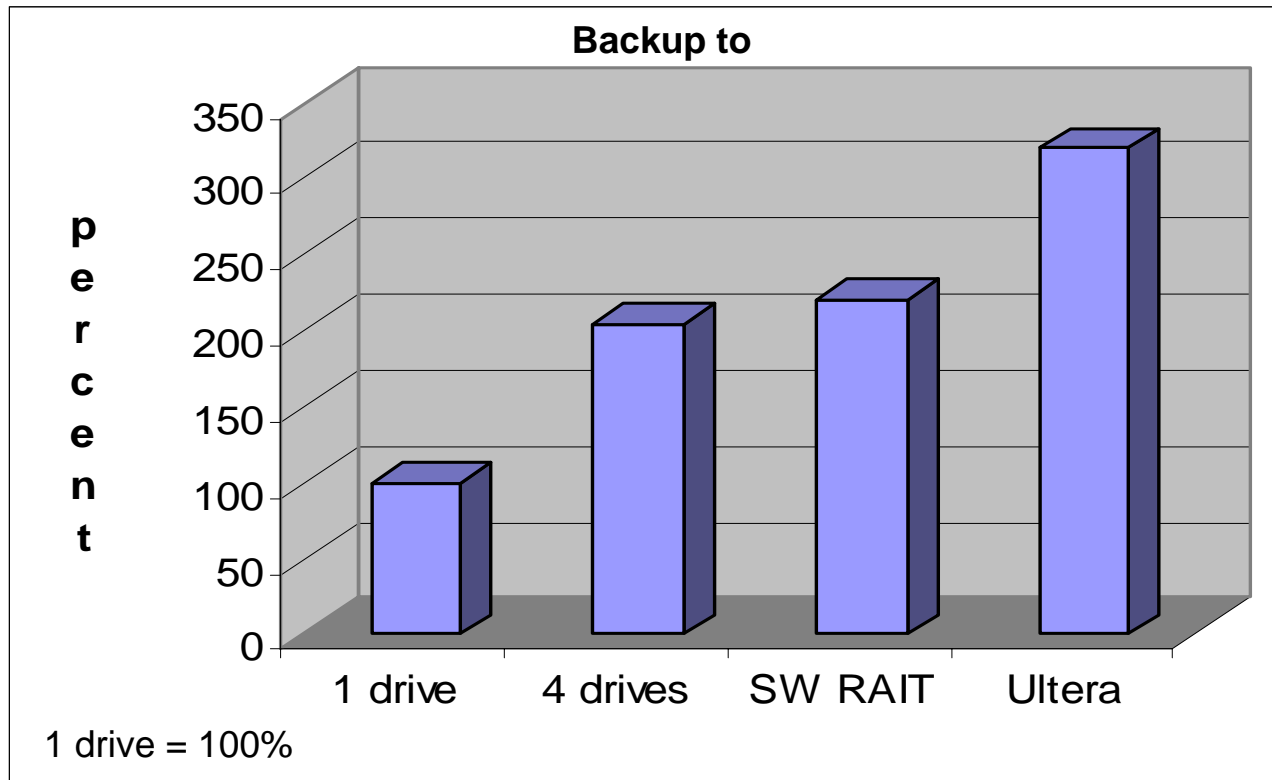
Tape RAID Reliability & Performance

Based on Backup or Restore Failure of 1 in 1000

RAIT Solutions

Some metrics

RAIT LEVEL	HOST INTERFACE	HOST DATA RATE	TAPE INTERFACE	TAPE DATA RATE	RELIABILITY INCREASE DUE TO RAIT
RAID 3 (3D + 1P)	2Gb FC	150 MB/sec	4 x U160 LVD/SE	3 X 50 MB/sec	200 X
RAID 3 (2D +1P)	2Gb FC	150 MB/sec	4 x U160 LVD/SE	2 X 75 MB/sec	330 X

VTL Solutions – Disk Based

Combining a VTL and RAIT provides major performance and reliability improvements for backups and archive

- VTL is not affected by the data rate from the server

- Archive from VTL to conventional runs server free

- Archive from VTL to conventional is done at full tape streaming speed for better tape drive reliability

- Full compatibility with any tape application software

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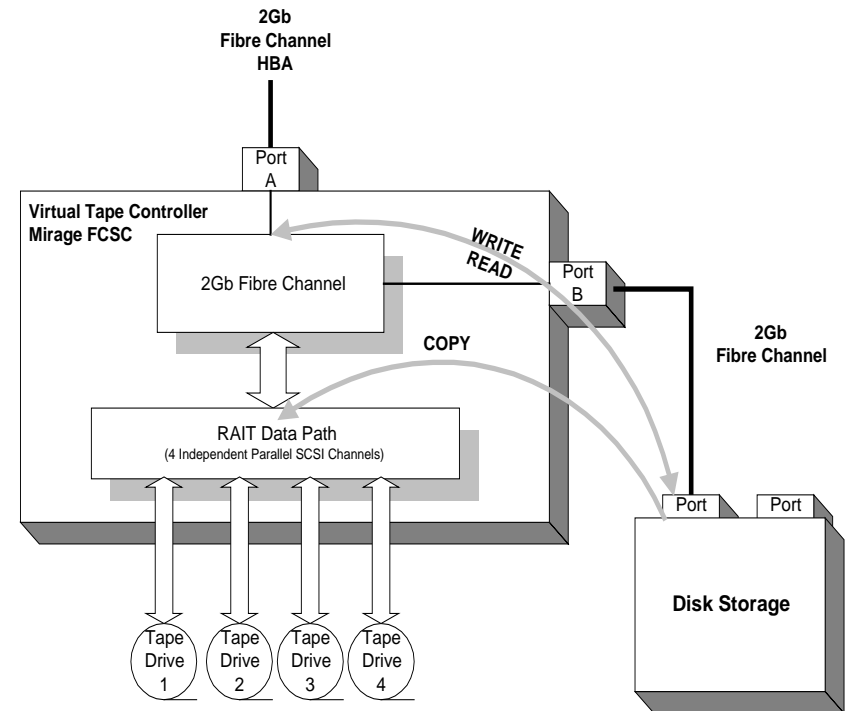
VTL Solutions – Disk Based

Some metrics per controller

Virtual Tape Controller	Host/Network Interface	Sustained Recording Speed to VTL MB/sec
SCSI only	U160 LVD/SE	140
FC only	2Gb FC	160
FC/SCSI	2Gb FC	160

Big block transfers

VTL Solutions – Disk Based

VT Controllers Currently Available

Virtual Tape Controller	Host/Network Interface	Disk/RAID Interface	Tape/Library Interface
SCSI only	U160	U160	U160
FC only	2Gb	2Gb	NA
FC/SCSI	2Gb	2Gb	4 x U160
Typical Products Qualified	HP IBM Sun Dell Brocade	ATA RAID SATA RAID SCSI RAID FC RAID SCSI disks ATA disks	LTO 1/2 DLT2/4/7/8 AIT1/2/3 SAIT DDS3/4 M1/2

Summary of VTL Benefits

- FLEXIBILITY – VTCs are independent of hardware/OS/software. VTC based VTL solutions can be used with other systems with different hardware/OS/software.

- ROI – VTCs can integrate with newer, faster, lower cost RAID systems as they become available. If archive to tape is not time critical, older tape systems can be used to save money.

- SCALABILITY - Multiple VTCs can be configured to meet performance and scalability requirements

- AVAILABILITY - Striped sets of tapes with parity insure successful backups and restores.

CONCLUSION

- **Virtual Tape Libraries in conjunction with RAIT archive provide the fastest and most reliable backups/restores and archives available today.**

- **Seamless integration of VTL solutions allows for plug & play into different platforms, providing high ROI and flexibility.**

- **RAIT protected set of tapes insure restoration of archived tapes.**

- **Thank you for your time. And Good Recording to tapes, virtual or conventional.**